IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

In re the Application of

Inventor	**:**	**Barry Scheirer et al.**
Application No.	**:**	**10/599,322**
Filed	**:**	**September 25, 2006**
For	**:**	**INTRACAVITY PROBE WITH CONTINUOUS SHIELDING OF ACOUSTIC WINDOW**

APPEAL BRIEF

On Appeal from Group Art Unit 3737
Examiner Joseph M. Santos

W. Brinton Yorks, Jr.

US PHILIPS CORPORATION
22100 Bothell Everett Highway
Bothell, WA 98021
Phone: (425) 487-7152
Fax: (425) 487-8135
email: brint.yorks@philips.com

Attorney for Appellant

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The real party in interest is Koninklijke Philips Electronics N.V., Eindhoven, The Netherlands by virtue of an assignment recorded September 25, 2006 at reel 018299, frame 0508.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

This application was originally filed with Claims 1-15. Claims 1-15 are pending and stand finally rejected by an Office Action mailed November 18, 2009. Claims 1-15 are the subject of this appeal.

IV. STATUS OF AMENDMENTS

No amendments or other filings were submitted in response to the final rejection mailed November 18, 2009. A notice of appeal was timely filed on February 4, 2010.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The subject matter of the claimed invention is a mechanical ultrasound probe. In mechanical probes the region being scanned is insonified by beams from an ultrasound transducer which is mechanically

oscillated back and forth, sweeping beams of ultrasound through the region of interest as it moves. In order to couple acoustic energy to and from the transducer, the moving transducer is contained in a fluid chamber, with the fluid providing acoustic coupling between the transducer and the acoustic window of the probe, through which the acoustic energy passes. Ultrasound probes are frequently used in the surgical suite where they are exposed to electromagnetic interference from surgical instruments such as cauterizing devices. To prevent such electromagnetic interference from contaminating the ultrasound images produced from signals from the transducer, it is desirable to shield the transducer from this interference. The conventional approach to this problem is to provide an RFI (radio-frequency interference) shield over the acoustic stack, which includes the piezoelectric transducer material, its acoustic backing, and the flex circuitry which couples signals to and from the piezoelectric transducer elements. The cited Talbot et al. patent is an example of this approach. The conventional approach works well in electronic probes in which the transducer does not move, and the ultrasound beams are electronically steered by signal phasing. The present inventors have found, however, that the usual approach is inadequate for highly sensitive mechanical probes. In particular they have discovered that the movement of the transducer assembly can

expose gaps in the acoustic stack to incoming electromagnetic interference. Additionally, the mechanical transducer drive mechanism can pick up stray electromagnetic interference which can find its way into the image signal path. Their solution to this problem is to line the acoustic window of the probe with a conductive layer that is coupled to ground. The conductive layer on or embedded in the acoustic window provides electromagnetic shielding for the entire fluid chamber, including both the moving acoustic stack and the mechanical drive mechanism which oscillates the stack inside the fluid chamber.

Claim 1 is supported by the drawings and specification as seen by reference numerals (#) of the drawings and the specification text (pg., ln) as follows:

1. An ultrasound probe which is shielded from electronic emissions comprising:

an ultrasonic transducer {#46; pg. 4, ln 7} located in a fluid chamber {#42; pg. 5, ln 2};

a movable mechanism {#48; pg. 4, ln 9-16} on which the transducer is mounted for scanning of the transducer;

an acoustic window {#34; pg. 4, ln 2-4} enclosing the fluid chamber through which ultrasonic energy is transmitted or received; and

a conductive layer {#38; pg. 5, ln 14-16} lining the acoustic window which provides electronic shielding of the fluid chamber and the transducer mechanism within the fluid chamber and which is coupled to a reference potential.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether Claims 1-15 were correctly rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

B. Whether Claims 1-13 were correctly rejected under 35 U.S.C. §103(a) as being unpatentable over US Pat. 4,802,458 (Finsterwald et al.) in view of U.S. Pat. 6,182,341 (Talbot et al.)

C. Whether Claim 14 was correctly rejected under 35 U.S.C. §103(a) as being unpatentable over Finsterwald et al. in view of Talbot et al. and further in view of US Pat. 5,311,095 (Smith et al.)

D. Whether Claim 15 was correctly rejected under 35 U.S.C. §103(a) as being unpatentable over Finsterwald et al. in view of Talbot et al. and further in view of US Pat. 5,488,954 (Sleva et al.)

VII. ARGUMENT

A. Whether Claims 1-15 were correctly rejected under 35 U.S.C. §112, second paragraph, as being indefinite

Claims 1-15 were rejected as being indefinite because the term “the transducer mechanism” in line 9 of Claim 1 lacks antecedent basis. The antecedent for this phrase is in the second element of the claim which describes “a moveable <u>mechanism</u> on which the <u>transducer</u> is mounted.” It is respectfully submitted that the phrase “the transducer mechanism”

does have antecedent basis earlier in the claim and that this would be clearly recognized by a reader of the claim.

B. Whether Claims 1-13 were correctly rejected under 35 U.S.C. §103(a) as being unpatentable over US Pat. 4,802,458 (Finsterwald et al.) in view of U.S. Pat. 6,182,341 (Talbot et al.)

The Examiner's presumption in paragraph 3 of the final rejection, that the subject matter of all of the claims has been commonly owned at all relevant times, is correct.

Finsterwald et al. describes a mechanical probe in which ultrasound transducers 44,46 are rotated in a fluid chamber and ultrasound is transmitted and received through an acoustic window of the cone assembly 22. The Examiner admits that Finsterwald et al. fails to disclose a conductive layer lining the acoustic window. In fact, Finsterwald et al. give no thought whatsoever to electronic emission shielding. The Finsterwald et al. patent is completely silent on this topic.

To provide this missing teaching, Talbot et al. was cited to combine with Finsterwald et al. Talbot et al. describes a fully electronic probe in which beams are steered, not by moving the transducer, but by phase control of signals to and from the transducer elements. Talbot et al. do not face the problems of the present invention as they have no moving transducer and no fluid chamber. They provide electronic shielding for

their transducer in the conventional manner, forming an RFI shield substructure over a portion of the acoustic stack, preferably by sputter deposition. See column 2, lines 62-64 and column 6, lines 2-4 of Talbot et al. The problem they are trying to solve is to have good adherence between the polyurethane window material and the RFI shield 54 which covers the acoustic stack. Their solution is to use a liquid primer to promote adhesion of the epoxy adhesive, then cast the polyurethane material directly on the epoxy (col. 5, first paragraph.) The teaching of Talbot et al. is the conventional one for someone skilled in the art: provide RFI shielding by forming a shield substructure over the acoustic stack.

Applying this teaching to the Finsterwald et al. probe, one skilled in the art would form the shield substructure over the transducers and transducer mount 42,44,46 to shield the transducers from electronic emissions. Applying the teaching to the probe shown in the drawings of the present application, one skilled in the art would form the shield substructure over the array transducer and transducer cradle 46,48. There is no suggestion to provide electronic emission shielding by lining the acoustic window with a conductive layer which shields not only the transducer mechanism, but also the fluid chamber in which the transducer travels. That teaching is found only in the present application.

Accordingly it is respectfully submitted that the combination of Finsterwald et al. and Talbot et al. cannot render Claim 1 and its dependent Claims 2-15 unpatentable.

As Claim 1 further recites that the conductive layer is coupled to a reference potential, the Examiner cites the mention of flex circuits in column 5, lines 4-8 of Talbot et al. as providing this coupling. The cited passage does not say that. The referenced flex circuits are the common way to couple signals to and from the transducer elements. Coupling the RFI shield to a ground conductor of the flex circuits would act to inject RFI interference from the shield directly into the ultrasound signal path, making the problem of RFI interference worst, not better. It is not clear from Talbot et al. how the RFI shield is electrically connected.

For the foregoing reasons it is respectfully submitted that the combination of Finsterwald et al. and Talbot et al. cannot render Claims 1-15 unpatentable.

C. Whether Claim 14 was correctly rejected under 35 U.S.C. §103(a) as being unpatentable over Finsterwald et al. in view of Talbot et al. and further in view of US Pat. 5,311,095 (Smith et al.)

Claim 14 recites that the conductive layer which provides electronic emission shielding exhibits a thickness of 1/16th of a wavelength or less. This is because the conductive layer is in the acoustic

path between the transducer and the body of the patient. Ultrasonic energy must pass freely between the transducer and the body and should not be attenuated or reflected by the conductive layer. The claimed thickness of the layer provides this characteristic.

To provide this feature the Examiner adds Smith et al. to the first two references. Smith et al. describe a layer 10 which the Examiner says makes the thickness of the claimed conductive layer obvious to one skilled in the art. However, column 4 of Smith et al. makes it clear that the layer 10 has exactly the opposite purpose of the conductive layer of the present invention. The layer 10 in Smith et al. is a mismatching layer located behind the transducer, not in the acoustic path. Its purpose is to provide an acoustic mismatch between the transducer elements and the ceramic connector at the back of the transducer so that acoustic energy emitted from the rear of the elements is not coupled into the connector. Rather than allowing ultrasound energy to freely pass through it, the mismatching layer reflects energy back into the transducer. One skilled in the art would never look to a mismatching layer when designing an element in the acoustic path in front of the transducer. Accordingly it is respectfully submitted that the combination of Smith et al. with the previous two references fails to make Claim 14 obvious.

D. Whether Claim 15 was correctly rejected under 35 U.S.C. §103(a) as being unpatentable over Finsterwald et al. in view of Talbot et al. and further in view of US Pat. 5,488,954 (Sleva et al.)

Claim 15 recites that the thickness of the conductive layer is in the range of 1000-3000 Angstroms. As discussed above, this is to make the conductive layer fully transmissive for ultrasonic energy traversing the acoustic path in front of the transducer. To provide a conductive layer of this thickness the Examiner refers to the aluminum conductive electrode 16 in Sleva et al., which is stated to have a thickness of 1000 Angstroms. However it is seen that electrode 16 of Sleva et al. is one of the signal electrodes of a Fresnel zone plate transducer and is shaped to give the transducer a Fresnel zone characteristic. The electrode 16 is on the back of the PVDF piezoelectric transducer material 14 and is not in the acoustic signal path. Its specified thickness is probably dictated by the deposition process that Sleva et al. use to manufacture their transducer. Its shape, not its thickness, is what is important to Sleva et al. The gold electrode 12, which is deposited on the upper surface of the piezoelectric, is the electrode that needs to be acoustically transparent, as Sleva et al. state at the top of column 8. Sleva et al. give no guidance as to what the thickness of electrode 12 should be. It is respectfully submitted that one skilled in the art would not look to a shaped electrode on the back of a Fresnel zone plate transducer when designing a conductive layer in the

acoustic path of an ultrasound transducer. Accordingly it is respectfully submitted that Claim 15 is patentable over Finsterwald et al., Talbot et al., and Sleva et al.

VIII. CONCLUSION

Based on the law and the facts, it is respectfully submitted that Claims 1-15 are clear and definite, and that Claims 1-15 are patentable over any combination of Finsterwald et al., Talbot et al., Smith et al. and Sleva et al. Lining the acoustic window of a mechanical probe with a conductive layer to shield the entire fluid chamber of the probe from electronic emissions, including the motive transducer assembly in the chamber, is not shown or suggested in any reference or combination thereof. Accordingly, it is respectfully requested that this Honorable Board reverse the grounds of rejection of Claims 1-16 of this application which were stated in the November 18, 2009 Office action being appealed.

Respectfully submitted,

BARRY SCHEIRER ET AL.

By: /W. Brinton Yorks, Jr./
W. Brinton Yorks, Jr.
Reg. No. 28,923

APPENDIX A: CLAIMS APPENDIX

The following Claims 1-15 are the claims involved in this appeal.

1. (previously presented) An ultrasound probe which is shielded from electronic emissions comprising:

an ultrasonic transducer located in a fluid chamber;

a movable mechanism on which the transducer is mounted for scanning of the transducer;

an acoustic window enclosing the fluid chamber through which ultrasonic energy is transmitted or received; and

a conductive layer lining the acoustic window which provides electronic shielding of the fluid chamber and the transducer mechanism within the fluid chamber and which is coupled to a reference potential.

2. (original) The ultrasound probe of Claim 1, wherein the conductive layer is located on the inner surface of the acoustic window.

3. (original) The ultrasound probe of Claim 1, wherein the conductive layer is embedded in the acoustic window.

4. (original) The ultrasound probe of Claim 1, wherein the acoustic window comprises a dome-shaped cap.

5. (original) The ultrasound probe of Claim 1, wherein the acoustic window comprises a relatively flat contact lens-shaped cap.

6. (original) The ultrasound probe of Claim 4, wherein the ultrasonic transducer comprises a curved array transducer which is oscillated to scan a volumetric region.

7. (original) The ultrasound probe of Claim 1, wherein the conductive layer is made of gold, a titanium/gold alloy, or aluminum.

8. (original) The ultrasound probe of Claim 1, wherein the

conductive layer is formed on the acoustic window by vacuum deposition processes such as sputtering, vacuum evaporation, physical vapor deposition, arc vapor deposition, ion plating or laminating.

9. (original) The ultrasound probe of Claim 1, wherein the conductive layer is coupled to a reference potential by conductive epoxy, solder connection, clamped pressure creating a metal-to-metal contact, conductive gaskets or O-rings, or discrete drain wires.

10. (original) The ultrasound probe of Claim 1, wherein the conductive layer comprises a continuous layer of conductive material.

11. (original) The ultrasound probe of Claim 1, wherein the conductive layer comprises a porous layer of conductive material.

12. (original) The ultrasound probe of Claim 11, wherein the porous layer comprises a grid-like screen of conductive material.

13. (original) The ultrasound probe of Claim 1, wherein the conductive layer is thin enough to be highly transmissive of ultrasound at a frequency of the transducer.

14. (original) The ultrasound probe of Claim 13, wherein the conductive layer exhibits a thickness of 1/16 of a wavelength or less of the frequency of the transducer.

15. (original) The ultrasound probe of Claim 13, wherein the conductive layer exhibits a thickness in the range of 1000-3000 Angstroms.

APPENDIX B: EVIDENCE APPENDIX

None. No extrinsic evidence has been submitted in this case.

APPENDIX C: RELATED PROCEEDINGS APPENDIX

None. There are no related proceedings.